

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent of Zheng Lu et al.
Patent No. 6,960,254 B2
Issued November 1, 2005
Confirmation No. 5338

For METHOD TO CONTROL THE CRYSTAL COOLING OR QUENCHING RATE BY
MEASURING CRYSTAL SURFACE TEMPERATURE

July 30, 2007

REQUEST FOR EXPEDITED ISSUANCE
OF CERTIFICATE OF CORRECTION UNDER 37 CFR 1.322

TO THE COMMISSIONER FOR PATENTS,

SIR:

On studying the above-identified patent, the following errors, apparently made in part by applicant, and in part by the Patent and Trademark Office, were found (these errors are also noted on the attached form PTO-1050):

** In column 14, claim 6, line 4, "to control to cooling" should read -- to control the cooling --.

In column 14, claim 8, line 18 "the ingot; an" should read -- the ingot: an --.

** In column 14, claim 9, line 38, "to control to cooling" should read -- to control the cooling --.

REMARKS

* In accordance with 37 CFR 1.322, a copy of Amendment A, dated April 21, 2005, and a copy of the Notice of Allowance dated June 24, 2005, are attached.

Since the errors shown above marked with double asterisks were made by applicant, the \$100.00 fee required under Rule 1.323 is paid herewith.

We respectfully request that a certificate of correction be issued.

Respectfully submitted.

A handwritten signature in black ink, appearing to read "Richard A. Schuth". The signature is fluid and cursive, with the first name "Richard" being more legible than the last name "Schuth".

Richard A. Schuth, Reg. No. 47,929
SENNIGER POWERS
One Metropolitan Square, 16th Floor
St. Louis, Missouri 63102
(314) 231-5400

RAS/dep

**UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION**

Page 1 of 1

PATENT NO : 6,960,254
APPLICATION NO.: 10/623,967
ISSUE DATE : November 1, 2005
INVENTOR(S) : Zheng Lu, Steven L. Kimbel

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 14

Claim 6, line 4, "to control to cooling" should read -- to control the cooling --.

Claim 8, line 18 "the ingot; an" should read -- the ingot: an --.

Claim 9, line 38, "to control to cooling" should read -- to control the cooling --.

MAILING ADDRESS OF SENDER (Please do not use customer number below):

Richard A. Schuth
Senniger Powers
One Metropolitan Square
16th Floor
St. Louis, Missouri 63102

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

if you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (currently amended): A method for use with a crystal growing apparatus for optimizing a cooling rate of a monocrystalline ingot grown according to the Czochralski process, said crystal growing apparatus having a heated crucible containing a semiconductor melt from which the ingot is grown, said ingot being grown on a seed crystal pulled from the melt, said crystal growing apparatus further having a receiving chamber into which the ingot is pulled, said ingot being pulled along a generally longitudinal path toward the receiving chamber, said method comprising:

determining a first temperature of the ingot when the ingot is at a first position along the path;

determining a second temperature of the ingot when the ingot is at a second position along the path, said first and second positions being separated by a distance D along the path;

determining a cooling rate of the ingot as a function of a difference between the first temperature and the second temperature relative to an amount of time for pulling the ingot the distance D;

generating a signal representative of an error between a target cooling rate of the ingot and the determined cooling rate of the ingot; and

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of Lu et al.

Art Unit:1765

Serial No. 10/623,967

Filed July 21, 2003

For METHOD TO MONITOR AND CONTROL THE CRYSTAL COOLING OR
QUENCHING RATE BY MEASURING THE CRYSTAL SURFACE TEMPERATURE

April 21, 2005

AMENDMENT A

TO THE COMMISSIONER OF PATENTS,

SIR:

In response to the non-final Office action mailed January 24, 2005, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks begin on page 11 of this paper.

adjusting one or more post-growth processing parameters as a function of the error signal thereby to control the cooling rate of the ingot.

Claim 2 (original): The method of claim 1, wherein determining the first temperature includes measuring the first temperature of the ingot at a location along the length of the ingot when the ingot is at the first position and determining the second temperature includes measuring the second temperature of the ingot at the same location along the length of the ingot when the ingot is at the second position.

Claim 3 (original): The method of claim 1 further comprising defining the target cooling rate from historical processing data stored in a memory.

Claim 4 (original): The method of claim 1 further comprising defining a temperature model representative of an estimated temperature profile along the length of the ingot based on a sensed temperature when the ingot is initially pulled from the melt, and wherein determining the first temperature includes estimating the first temperature of the ingot at the location along the length of the ingot when the ingot is at the first position along the path from the temperature model, and wherein determining the second temperature includes measuring the second temperature of the ingot surface at the same location along the length of the ingot when the ingot is at the second position after the ingot is pulled the distance D along the path toward the receiving chamber.

Claim 5 (original): The method of claim 1, wherein determining the cooling rate includes calculating a cooling rate C_R by the following:

$$C_R = (T_1 - T_2)/t$$

where T_1 is the first temperature, T_2 is the second temperature, and t is the amount of time required for the ingot to be pulled the distance D .

Claim 6 (original): The method of claim 1, wherein the ingot is pulled along the path toward the receiving chamber at a pull rate, and wherein adjusting the post growth processing parameter includes:

- determining a pull rate set point as a function of the error signal; and
- adjusting the pull rate according to the pull rate set point to control to cooling rate of the ingot.

Claim 7 (original): The method of claim 1, wherein the crystal growing apparatus has a heater positioned above the melt for heating the ingot as it is pulled along the path into the receiving chamber, and wherein adjusting the post growth processing parameter includes:

- determining a heater power set point as a function of the error signal; and
- adjusting power supplied to the heater according to the heater power set point to control the cooling rate of the ingot.

Claim 8 (original): The method of claim 1, wherein adjusting the post growth processing parameter includes adjusting at least one of the following to control the cooling rate of the ingot: an argon gas flow rate; furnace pressure; heater power; and pull rate.

Claim 9 (currently amended): A method for use with a crystal growing apparatus for optimizing a cooling rate of a monocrystalline ingot grown according to ~~the~~ a Czochralski process, said crystal growing apparatus having a heated crucible containing a semiconductor melt from which the ingot is grown, said ingot being grown on a seed crystal pulled from the melt, said crystal growing apparatus further having a receiving chamber into which the ingot is pulled, said ingot being pulled along a generally longitudinal path toward the receiving chamber, said method comprising:

measuring a temperature of the ingot at a location along the length of the ingot at a position along the path;

generating a signal representative of an error between a target temperature of the ingot when it is at the position along the path and the measured temperature of the ingot; and

adjusting one or more post growth processing parameters as a function of the error signal thereby to control to cooling rate of the ingot.

Claim 10 (original): The method of claim 9 further comprising defining the target temperature from historical processing data stored in a memory, and wherein the target temperature is dependent on the position along the path at which temperature is being measured

Claim 11 (original): The method of claim 9, wherein adjusting the post growth processing parameter includes adjusting at least one of the following to control the cooling rate of the ingot: an argon gas flow rate; furnace pressure; heater power; and pull rate.

Claim 12 (currently amended): An apparatus for use with a crystal growing apparatus for optimizing a cooling rate of a monocrystalline ingot grown according to ~~the~~ a Czochralski process, said crystal growing apparatus having a heated crucible containing a semiconductor melt from which the ingot is grown, said ingot being grown on a seed crystal pulled from the melt, said crystal growing apparatus further having a receiving chamber into which the ingot is pulled, said ingot being pulled along a generally longitudinal path toward the receiving chamber, said method comprising:

a first temperature sensor positioned along the path of the ingot for measuring a first temperature of the ingot surface at a location along the length of the ingot when the ingot is at a first position along the path;

a second temperature sensor positioned along the path of the ingot for measuring a second temperature of the ingot surface at the same location along the length of the ingot when the ingot is at a second position along the path, said first and second positions being separated by a distance D;

a controller for generating an error signal representative of an error between a target cooling rate of the ingot and a calculated cooling rate of the ingot, said calculated cooling rate being calculated as a function of a difference between the first temperature

and the second temperature relative to an amount of time for pulling the ingot the distance D; and

a processing component responsive to the error signal for adjusting a processing parameter set point as a function of the error signal to control the cooling rate of the ingot.

Claim 13 (original): The apparatus of claim 12, wherein the processing component generates a pull rate set point as a function of the error signal, and wherein a puller motor is responsive to the pull rate set point generated by the processing component to adjust the pull rate of the ingot thereby controlling the cooling rate of the ingot.

Claim 14 (original): The apparatus of claim 12, wherein the crystal growing apparatus has a heater positioned above the melt for heating the ingot as it is pulled along the path into the receiving chamber, and wherein the processing component generates a heater power set point for the power supplied to the heater as a function of the error signal, and wherein a power supply is responsive to the heater power set point generated by the processing component for adjusting the power supplied to the heater thereby controlling the cooling rate of the ingot.

Claim 15 (original): The apparatus of claim 12, wherein the processing component generates a flow rate set point for an argon gas being introduced into the crystal growing apparatus as a function of the error signal, and wherein an argon flow component is

responsive to the flow rate set point generated by the processing component to adjust the flow rate of the argon gas thereby controlling the cooling rate of the ingot.

Claim 16 (original): The apparatus of claim 12, wherein the temperature sensor is configured to sense a temperature of an ingot surface, and generates a temperature signal representative of the sensed temperature.

Claim 17 (original): The apparatus of claim 12 further including a central processing unit for processing historical processing data to identify the target cooling rate and a memory for storing the target cooling rate.

Claim 18 (original): The apparatus of claim 12, wherein an operator uses a computer linked to a memory to define the target cooling rate.

Claim 19 (currently amended): An apparatus for use with a crystal growing apparatus for optimizing a cooling rate of a monocrystalline ingot grown according to the a Czochralski process, said crystal growing apparatus having a heated crucible containing a semiconductor melt from which the ingot is grown, said ingot being grown on a seed crystal pulled from the melt, said crystal growing apparatus further having a receiving chamber into which the ingot is pulled, said ingot being pulled along a generally longitudinal path toward the receiving chamber, said method comprising:

a temperature sensor positioned along the path of the ingot for measuring a temperature of the ingot surface at a location along the length of the ingot when the ingot is at a position along the path;

a controller for generating an error signal representative of an error between a target temperature of the ingot when it is at the position along the path and the measured temperature of the ingot; and

a processing component responsive to error signal for adjusting a processing parameter set point as a function of the error signal to control the cooling rate of the ingot.

Claim 20 (original): The apparatus of claim 19, wherein the target temperature is defined from historical processing data stored in a memory, and wherein the target temperature is dependent on the position along the path at which temperature is being measured

Claim 21 (original): The apparatus of claim 19, wherein the processing component generates a pull rate set point as a function of the error signal, and wherein a puller motor is responsive to the pull rate set point generated by the processing component to adjust the pull rate of the ingot thereby controlling the cooling rate of the ingot.

Claim 22 (original): The apparatus of claim 19, wherein the crystal growing apparatus has a heater positioned above the melt for heating the ingot as it is pulled along the path into the receiving chamber, and wherein the processing component generates a heater power set point for the power supplied to the heater as a function of the error signal, and

wherein a power supply is responsive to the heater power set point generated by the processing component for adjusting the power supplied to the heater thereby controlling the cooling rate of the ingot.

Claim 23 (original): The apparatus of claim 19, wherein the processing component generates a flow rate set point for an argon gas being introduced into the crystal growing apparatus as a function of the error signal, and wherein an argon flow component is responsive to the flow rate set point generated by the processing component to adjust the flow rate of the argon gas thereby controlling the cooling rate of the ingot.

REMARKS

Applicants have carefully considered the Examiner's remarks and have amended the application in light thereof. Applicants acknowledge the Examiner's indication that claims 2-8, 10, 11, 13-18, and 20-23 contain allowable subject matter. By this Amendment A, claims 1, 9, 12, and 19 have been amended. Thus, claims 1-23 are now pending in the application. Reconsideration of the application claims as amended and in view of the following remarks is respectfully requested.

Claim Rejections based on 35 U.S.C §112

Claims 1, 9, 12, and 19 stand rejected under 35 U.S.C § 112 due to insufficient antecedent basis for a claimed limitation. More specifically, the Examiner asserts that each of claims 1, 9, 12, and 19 include the limitation “Czochralski process” and that there is insufficient antecedent basis for this claimed limitation. As suggested by the Examiner, applicants have amended each of the claims 1, 9, 12, and 19 to have proper antecedence by inserting the word “a” before the word “Czochralski.” Applicants submit that independent claims 1, 9, 12, and 19 are now in compliance with 35 U.S.C § 112, and, thus are in condition for allowance.

Claim Objections

Claims 2-8, 10, 11, 13-18, and 20-23 are objected to as being dependent upon a rejected base claim. However, since amended independent claims are compliance with 35 U.S.C § 112, applicants submit that the remaining dependent claims are allowable for at least the same reasons as the claims from which they depend.

Summary and Concluding Remarks

For the reasons noted above, applicants respectfully submit that claims 1-23 are in condition for allowance and respectfully requests favorable reconsideration of this application.

The Commissioner is hereby authorized to charge any deficiency or overpayment of any required fee during the entire pendency of this application to Deposit Account No. 19-1345.

Respectfully submitted

A handwritten signature in cursive script, appearing to read "Robert M. Bain".

Robert M. Bain, Reg. No. 36,736
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RMB/ROE/jmd



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NOTICE OF ALLOWANCE AND FEE(S) DUE

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06/24/2005

RMB / ROE / ECH

SENNIGER POWERS LEAVITT AND ROEDEL
ONE METROPOLITAN SQUARE
16TH FLOOR
ST LOUIS, MO 63102

EXAMINER

HITESHEW, FELISA CARLA

ART UNIT

PAPER NUMBER

✓1722

DATE MAILED: 06/24/2005 ✓

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
✓10/623.967	✓07/21/2003	✓Zheng Lu	✓MEMC 02-0400 (3053)	✓538

TITLE OF INVENTION: METHOD TO MONITOR AND CONTROL THE CRYSTAL COOLING OR QUENCHING RATE BY MEASURING CRYSTAL SURFACE TEMPERATURE ✓

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO ✓	\$1400	\$300	\$1700	09/26/2005 ✓

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. **PROSECUTION ON THE MERITS IS CLOSED.** THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. **THIS STATUTORY PERIOD CANNOT BE EXTENDED.** SEE 35 U.S.C. 151. THE ISSUE FEE DUE, INDICATED ABOVE REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

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JUN 27 2005

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/623,967 ✓	07/21/2003 ✓	Zheng Lu ✓	MEMC 02-0400 (3053) ✓	5338 ✓
000321	7540	06/24/2005 <i>rmb / Roe / ESH</i>		
SENNIGER POWERS LEAVITT AND ROEDEL ONE METROPOLITAN SQUARE 16TH FLOOR ST LOUIS, MO 63102				
EXAMINER HITESHEW, FELISA CARLA				
ART UNIT		PAPER NUMBER		
1722 ✓				

DATE MAILED: 06/24/2005

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 125 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 125 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571) 272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.

gob
mm

Notice of Allowability

Application No.

10/623,967

Examiner

Felisa C. Hiteshew

Applicant(s)

LU ET AL.

Art Unit

1722

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the amendment filed on April 21, 2005.
2. ☒ The allowed claim(s) is/are 1-23.
3. ☒ The drawings filed on _____ are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
- b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____
7. ☐ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____

FELISA HITESHEW
PRIMARY EXAMINER

4/17/05

Allowable Subject Matter

1. Claims 1-23 are allowed.
2. The following is an examiner's statement of reasons for allowance: The most relevant prior art of reference was that which was submitted by the applicants.
However, they do not teach nor fairly suggest singularly or in any combination thereof a method for use with a crystal growing apparatus for optimizing a cooling rate of a monocrystalline ingot grown according to a Czochralski process, said crystal growing apparatus having a heated crucible containing a semiconductor melt from which the ingot is grown, said ingot being grown on a seed crystal pulled from the melt, said crystal growing apparatus having a receiving chamber into which the ingot is pulled, said ingot being pulled along a generally longitudinal path toward the receiving chamber said method comprising: determining a first temperature of the ingot when the ingot is at a first position along the path; determining a second temperature of the ingot when the ingot is at a second position along the path, said first and second positions being separated by a distance D along the path; determining a cooling rate of the ingot as a function of a difference between the first temperature and the second temperature relative to an amount of time for pulling the ingot the distance D ; generating a signal representative of an error between a target cooling rate of the ingot and the determined cooling rate of the ingot; and adjusting one or more post-growth processing parameters as a function of the error signal thereby to control the cooling rate of the ingot.

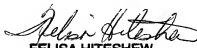
Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Felisa Hiteshew whose telephone number is (571) 272-1463. The examiner can normally be reached on Mondays through Thursdays from 4:30 AM to 3:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech, can be reached on (571) 272-1137. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-1463.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866- 217-9197 (toll-free).


FELISA HITESHEW
PRIMARY EXAMINER
AL 1722